BLACK HILLS BEETLE CONDITIONS

DIXIE NATIONAL FOREST

AND

BRYCE CANYON NATIONAL PARK

UTAH

September - October 1954
Appraisal Survey

By

R. I. Washburn

INTRODUCTION

The Black Hills beetle, Dendroctonus ponderosae Hopk., continues to be a major obstacle in the maintenance of the southern Utah ponderosa pine stands. The present epidemic is now going into its fifth year. During the previous four years an estimated 7.4 million board feet of timber have been killed on the Forest and the Park. In addition there are at present approximately 2.5 million board feet of timber infested. There could have been, due to the "build-up" potential, approximately 6.4 million board feet of timber now infested if treatment of 9,700 trees had not been accomplished this year.

SURVEY METHODS

In order to be better able to evaluate the present epidemic, infestation, and the effectiveness of the 1954 control project, an appraisal survey was conducted. A systematic ground cruise was employed on all areas known or suspected of containing ponderosa pine trees that were or had been infested with the Black Hills beetle. On the Mammoth Division and Escalante Division a 5% line plot survey was used on all but a few of the units. On these units, because of their small sizes and the nature of the infestation pattern, a 10% cruise was conducted. The techniques and methods for both the 5% and 10% cruises were identical except that twice as many lines were run on the unit cruised 10%. A 1/5 acre circular plot was taken every 2 chains along parallel lines run in the cardinal direction most nearly at right angles to the major contour. These lines were run 20 chains apart in the 5% cruise (10 chains for the 10%) and were tied into section lines to facilitate mapping. The East Fork Division and Bryce Canyon National Park were cruised to a 5% intensity by horse-mounted cruisers running chain-wide strips. The strip runner ran parrallel compass lines up and down the slopes 20 chains apart, and mapped and recorded the cruise data on

aerial photos and data sheets. Information recorded on all strips and lines included the number and the DBH of all infested trees within the sample. On each infested tree the number of points of attack on a 1/2 sq. ft. (6 inches wide by 12 inches high) at breast height facing the center of the plot or strip was recorded. This information was attained by the removal of the 1/2 sq. ft. bark sample and counting the starts of galleries as they appeared on the wood surface. Data concerning the presence or absence of other Dendrootonus, particularly D. convexifrons, was also gathered from the 1/2 sq. ft. samples. No count of the brood was possible because of the late attack of D. ponderosae. All 1953 attacked trees that still contained brood were recorded to determine if a significant beetle population was still present in these trees. The number of 1953 trees from which the beetles had flown and the number of 1953 treated trees were also tallied. The latter figure provided a check on the reliability of the survey by units.

SURVEY DATA BY UNITS

East Fork Division

The East Fork of the Sevier Division coincides with the East Fork of the Sevier Forest Service working unit. The area lies east of Panguitch, Utah and U. S. highway 89, and is adjacent to Bryce Canyon National Park. This year all of the timber type on the Paunsaugunt Plateau south of State highway 12 was surveyed. In addition all of the pine type in Red Canyon, Casto Creek, and the Pines was surveyed. All together 89,000 acres were surveyed on the East Fork Division. There are now approximately 5,540±776 infested trees on this Division. About 2,455 of these trees are located within the 1954 control boundaries with the remaining 3,085 located on the new areas.

A discussion of the individual units follows:

1. Badger-Ahlstrom - 15,400 acres, 580±215 infested trees.

The Badger-Ahlstrom unit is an area of 15,400 acres and lies west of the East Fork Creek, north of Badger Creek and runs on up through Blue Fly and Ahlstrom to out of type. Approximately 380 of the infested trees lie between Badger Creek and Blue Fly Creek. The rest of the infested trees, approximately 140, are scattered throughout the large area between Blue Fly and Ahlstrom Hollow.

2. Daves Hollow-East Creek - 8,500 acres, 180±58 infested trees.

The Daves Hollow-East Creek unit is that area that falls between the East Fork of the Sevier and the Forest Park boundary. The north boundary is the edge of type and the south boundary the drift fence that runs approximately down the south ridge of East Creek. This area is largely a cut-over area, and has for the past 3 years contained a relatively light incident of beetle trees.

3. East Creek-Crawford - 13,100 acres, 820±210 infested trees.

The East Creek-Crawford unit inoludes 13,100 acres south of the East Creek drift fence and extends to the south ridge of Sieler Creek. The area is bounded by the National Forest boundary to the east and the East Fork of the Sevier on the west. The extension of the unit from the south ridge of Podunk Creek to the south ridge of Sieler Creek represents an increase in area of about 2,800 acres over the old control unit. During the 1954 control project 1,575 infested trees were treated in the unit. The area within the control unit now contains approximately 615 newly infested trees. This represents a 61% reduction in the number of infested trees. There still is, however, an undesirable concentration of beetle trees containing large aggressive broods within this unit. The heaviest concentration of infested trees is located south of Podunk Creek.

4. Badger-Robinson - 30,500 acres, 2960±750 infested trees.

This area is largely a new unit that contains all of the old Crawford Creek-Skunk Creek unit, Kanab Creek unit, Blubber Creek unit, and in addition encompasses all of the timber on the plateau west of the East Fork of the Sevier and south of Badger Creek. Approximately 774 trees were treated within this unit in 1954 which helped to produce a 26% reduction on the treated portions. Unfortunately, however, the infestation has now blossomed out over all of the timber surrounding these old control units. The unit now contains the largest concentration of beetle trees on the Dixie National Forest. The estimated 2,960 infested trees are represented mostly by groups, some of them fairly large, 10 to 30 trees. The survey data shows the infested trees in the unit have an average of 6.4 points of attack per sq. ft. of bark surface at breast height which indicates that the unit contains one of the largest potential infestation populations.

5. Proctor Canyon - 500 acres, 230 infested trees.

This canyon is the only unit off of the west side of the Paunsaugant Plateau. It lies immediately west of the head of Blue Fly Creek. All the pine type, approximately 500 acres, of Proctor Canyon was included within this scouted unit. No control action was undertaken on this unit last year. Assuming that last year's estimate of 50 trees was correct, the 230 trees now on the area represent a 4 to 1 build-up.

6. Pines-Red Canyon - 20,000 acres, 470 infested trees.

This year a thorough examination was given to all of the timber in the Pines area as well as the pine timber in the many canyons adjoining the Pines. All of the Red Canyon area was inspected to determine if this heavily used scenic and recreational area was becoming excessively infested. It was found that most of the trees infested in the Pines were hit high. The attacks did not appear to extend much below mid-crown on most of the trees observed. Obviously with this type of attack pattern it may have been very possible that infested trees were missed at the time of the survey. There are some infested trees along the main highway running through Red Canyon, but not in such numbers that they should be unduly noticeable to the passer-by.

7. Ponderosa-Willis - 500 acres, 150 trees.

Ponderosa Canyon and Willis Creek are stringers of ponderosa pine timber running below the Bryce Canyon rim. The Park-Forest boundary bisects both of these canyons. It is difficult to estimate the number of trees within each managership. Our best judgment, however, would place approximately 150 of the infested trees in the Forest and 250 trees within the Park boundary.

8. Barney-Bluff - 500 acres, 150 trees.

This mature stand of ponderosa pine is situated on a flat table between Casto Canyon and a head of Lilm Kiln Creek. The commercial timber on this unit is isolated from other merchantable stands but is surrounded by very ragged pine timber sparsely growing on a very poor site. These trees would always remain as a source of infection for the merchantable stand. Therefore, the only practical way to reduce the loss caused by the beetle to this merchantable timber is through logging.

Mammoth Division

All areas previously surveyed were resurveyed, some being expanded and, in addition, several new units were cruised this year. Actually the 71,700 acres surveyed represents an increase of 42% in area surveyed. Approximately 2615±314 trees are now infested on this division. The new units contain about 995 of these trees, whereas 1,620 trees are located on the units on which 3,411 trees were treated this spring. This means that on the control area there are now 53% less trees than were treated. The reduction by units varied from 80+% Cooper Peak, Prince Mountain, Lower Dry Valley, to 40% or less for Bower Flat-Mammoth, Blue Springs, and Little Creek-Red Creek units.

Details concerning individual units of the Mammoth Division are as follows:

9. Strawberry - 18,900 acres, 670±187 infested trees.

The Strawberry unit is a new unit due south of the Bower Flat-Mammoth unit. The unit boundaries are highway 14, the east ridge of Swain's Creek, the Plateau rim on the south, and Duck Creek to the west. The 670 infested trees on the 18,900 acres surveyed represent approximately 3 times as many trees as there were last year. The trees were found primarily in small groups of 2 to 4 trees.

10. Bower Flat-Mammoth - 18,700 acres, 710±160 infested trees.

The Bower Flat-Mammoth unit is a timbered area north of State highway 14 extending north on both sides of the Panguitch Lake-Duck Creek road to Mammoth Creek. A count of the 53 trees not treated shows that there is a ratio of approximately 1.5 new attacks for every one of the 440 estimated trees not treated on the unit. The untreated trees were

found mainly in lava pockets and other difficult places to treat. Actually there are now about 36% less trees (710±160) than were treated (1,111 trees) on the unit this year.

11. Rock Canyon - 5,900 acres, 210±75 infested trees.

Rock Canyon unit is that area bounded on the southwest and west sides by lava flows, Rock Canyon Creek on the north, and on the east and south by the edge of type. This unit of 5,900 acres was treated primarily by salvage logging. Approximately 723 trees were salvaged or treated. There are now present 210±75 or about 71% less than the number of trees salvaged or treated.

12. Haycook Mountain - 6,600 acres, 250±80 infested trees.

The Haycock Mountain unit is the area of pine timber south of the Panguitch Lake Road and east and north of Pass Creek. Salvage logging operators removed all but a few of the 489 infested trees on the Haycock Mountain unit. The rest of the trees were treated by Forest Service crews. The fall survey estimates 250±80 infested trees now on the unit.

13. Blue Springs Mountain - 3,900 acres, 150±110 infested trees.

The Blue Springs Mountain unit has been expanded to include all of the pine timber from Deer Creek to Dry Valley and extends from the top of Blue Springs Mountain east to the lava flow. The 150±110 infested trees are scattered throughout the 3,900 acres.

14. Cooper Peak - 3,200 acres, 40±28 infested trees.

The Cooper Peak unit is centered by Cooper Peak. Cooper Peak is located on the southeast shore of Panguitch Lake and is separated by Pass Creek from the Hayoock Mountain unit to the east and the Rim and lava from Rook Canyon unit to the south. The unit was not surveyed last year but during the control operation the necessity of treating this area was recognized and 250 infested trees were located and either removed by logging or treated. The survey figures show that there now are approximately 40±20 infested trees on this unit. This reduction of about 84% over the number of trees treated would tend to support the feeling that a good thorough job of spotting and treating or removal of the infested trees had been conducted.

15. Five Mile Bench - 1,000 acres, 30±27 infested trees.

The Five Mile Bench unit is an isolated stand of pine located between Five Mile Creek and Panguitch Creek and approximately 5 miles west of the town of Panguitch. In 1954, 75 trees were treated and it is estimated that there are now 30±27 newly infested trees scattered throughout the 1,000 acres of timber on Five Mile Bench.

16. Prince Mountain - 600 acres, 10±9 infested trees.

The Prince Mountain unit is situated on the west side of Panguitch Lake and contains the only large developed campground near the lake. In 1954, 78 trees were located and treated on this unit. There are now approximately 10±9 newly infested trees present within this area.

17. Little Creek-Red Creek - 1,700 acres, 130±59 infested trees.

The Little Creek-Red Creek unit consists of the patches of ponderosa pine timber, located around the Red Creek reservoir, which overlook the towns of Paragonah and Parowan. Two years ago treatment began on this unit at which time 802 trees were treated. On 750 acres the concentration of infested trees reached one tree per acre with groups containing as high as 250 infested trees. Last year 169 trees were located and treated and it is estimated that 130 trees are now infested.

18. Upper Mammoth - 2,200 acres, 30±25 infested trees.

The pine timber on the slopes of the Mammoth Creek ridge from the junction of the road and Mammoth Creek, south to where Tommy Creek joins the Mammoth, is considered the Upper Mammoth Creek unit. A light infestation of approximately .014 new attacks per acre, about 30 infested trees, is present upon this unit.

19. Lower Dry Valley - 600 acres, 50 infested trees.

The Lower Dry Valley unit is located between the Bower Flat-Mammoth unit and the Blue Springs Mountain unit. The northeastern edge of the unit borders a large lava flow that separates it from the Rock Canyon timber stand. The southwestern boundary is the Panguitch Lake-Duck Creek road and Mammoth Creek. The control efforts directed toward the infestation on this unit caused the removal or treatment of 303 infested trees. A systematic 5 percent cruise was conducted on this unit after the beetle flight this fall and no newly infested trees were reported. Obviously there must be some infested trees within the unit. After analyzing the survey data and interviewing the strip runner, we can only assume that a marked reduction in the number of infested trees has taken place. The impression of the strip runner of less than 50 trees should be considered the best guess.

20. Ike's Valley - 2,600 acres, 100±39 infested trees.

Ike's Valley is an area just north of State highway 14 on Swain's Creek. Actually this area is a continuation of the Strawberry unit and is separated mainly because of the change in stand characteristics. The unit contains about 100±39 infested trees.

21. Stout Canyon - 2,600 acres, 40 infested trees.

Stout Canyon is located east of the Strawberry unit and just west of U. S. highway 89. A reconnaissance type survey was conducted in this area to determine if the increase of beetle activity had

extended this far east of the Strawberry unit. Approximately 40 infested trees were found in this drainage but the infestation pattern and the insect population indicate that the damage potential is much lower here than in the Strawberry unit.

22. Asay Bench - 1,300 acres, 155±59 infested trees.

The Asay Bench unit lies just east of the Bower Flat-Mammoth unit and includes the area between Asay Creek and the north side of the west fork of Asay Creek. There appears to be approximately 155 newly infested trees averaging 36 inches DBH. There are, however, only about 2.6 starts of Black Hills beetle galleries per sq. ft. of bark surface. Most of the trees are filled in with attacks of D. barberi and D. convexifrons.

23. Hatch Mountain - 1,900 acres, 40±30 infested trees.

The Hatch Mountain unit is located approximately 1/2 mile east of the Rock Canyon unit and separated from it by a narrow sage valley. Only 10 trees were treated on the unit in 1954. There now appears to be about 40±30 newly infested trees.

Escalante Division

The Escalante Division is the area of pine timber, within the Dixie National Forest boundaries, that encloses the drainages feeding the Escalante River. The rather heavy loss caused by what might be called a high endemic bark beetle population continues throughout the district. The infested trees have been attacked by a mixture of D. ponderosae, D. barberi, and D. convexifrons.

24. Pine Creek - 4,600 acres, 320±111 infested trees.

This local build-up reported in last year's survey report was treated in the spring. Even though 425 trees were located and treated or salvaged, there remains an infestation of about 320±111 newly infested trees.

Reconnaissance Scouting

Several areas that were suspected of having an abnormal number of infested trees were inspected. They were on the Mammoth Division, Yankee Meadows, Ipson Mountain; on the East Fork Division, Lower Swapp Hollow and Robinson; and on the Escalante Division, Hog Ranch, Sand Wash, and Upper Valley. None of these areas contain what could be termed a threatening infestation population. There are, however, approximately 50 D. barberi and D. convexifrons trees scattered throughout the Hog Ranch and about the same number in Sand Wash.

Bryce Canyon National Park

10,830 acres, 910±410 infested trees.

The area within the Bryce Canyon National Park has been divided into 3 units, the 2 units above the Rim being that area north of East Creek running to the Park gate and the area south of East Creek extending to the south Park boundary. All of the area below the Rim is considered one unit even though the Willis Creek-Swamp area is actually separated from the Ponderosa Canyon timber. There appears to be about 65% less infested trees now than the number of trees treated in 1954 on the control area. The distribution of the newly infested trees appears to be 20±24 trees on the 1,700 acres of the East Creek-North unit and 640±289 trees on the 8,400 acres of the East Creek-South unit. Below the Rim it is estimated that there are now about 100 infested trees in the Willis and Swamp and 150 infested trees in Ponderosa Canyon within the Park boundary.

SURVEY SUMMARY

A systematic review of the Dixie National Forest and Bryce Canyon National Park was desirable to determine the present status of the Black Hills beetle outbreak, the effect of the control operation, and if any clues were available that would help in any prediction of the future of the epidemic. The Dixie National Forest contains 8,475±763 newly infested trees on about 170,000 acres. The infested trees are present on 24 units. Bryce Canyon National Park is now infested with approximately 910±410 newly attacked trees on 10,830 acres. The concentration of attacked trees, size of attacked trees, and the population density of the insect vary considerably between units.

A very encouraging reduction in the number of infested trees was recorded on a number of the control units. The Mammoth Division now has 54% less infested trees within the 1954 control units, with some individual units indicating as much as 80+% fewer infested trees than were treated during the summer of 1954. The East Fork Division figures show 39% less infested trees on the controlled area than were treated. On the National Park there now appears to be about a 65% reduction in the number of infested trees.

The intensity of attack data interestingly indicates that for the last 3 years the average DBH of attacked trees on the National Forest has not varied; 19.1 inches in 1952, 19.9 inches in 1953, and 19.5 inches in 1954. The data also shows that although the number of points of attack increased from 4.0 per sq. ft. in 1952 to 5.4 per sq. ft. in 1953, it has remained 5.4 per sq. ft. of bark for 1954 for the Dixie National Forest average. The survey figures indicate that of the 20 units on which '53 tree data was collected, 11 units were subjected to a build-up of attacked trees of 1.5 or more new trees for every '53 tree not treated. Four of these units had a build-up ratio of 2 to 1 or more.

DISCUSSION AND RECOMMENDATIONS

In order to intelligently ascertain if certain areas warrant control action from an entomological standpoint it is necessary to consider a number of important factors. In other words, the Dixie-Bryce epidemic cannot be interpreted by using as the only basis, the number of infested trees per acre. Factors used for evaluating conditions within this epidemic include: the population potential index (calculated by multiplying the average DBH of the infested tree by the average number of starts of galleries /points of attack/ per sq. ft. of cambium surface), and the population potential index trend for the last 3 years; the build-up ratio of infested trees; the concentration of infested trees recorded as new attacks per acre; the attacked tree arrangement within the stand; and an important factor that cannot be calculated until spring - the health and population density of the beetle brood.

The standards adopted as the requirements needed to qualify for the highest priority are: a build-up ratio of 2 to 1 or more; at least .1 new attack per acre; a minimum population potential index of 100; and a population potential index trend upwards for the last 3 years.

Two units, Badger-Robinson and Bryce Canyon, qualify for this first priority bracket. The relative position of the other units is shown on the bar graph. If the Badger-Robinson and Bryce Canyon units can qualify for treatment on an economic basis, cost of treatment, values at stake etc., it becomes necessary to designate a sound entomological control area. If the 2 units mentioned are to be considered for a control program, the East Creek-Crawford unit must be included within the project plans since it lies between the two units. The East Creek-Crawford unit does contain, at its southern end, the attacked tree arrangement and a new attack concentration that represents a serious potential threat to the surrounding timber. The concentration of new attacks will reach about 1 tree per acre in at least one of the small side drainages of the East Fork. The Daves Hollow-East Creek unit can be eliminated from any plans for treating the areas of highest priority only. This unit is primarily a cutover area and the new attacks are mostly singles scattered throughout the stand. No effort was made to separate the index data of the two subdivisions above the rim of Bryce Canyon. However, observations indicate that the nature of the infestation on the Park follows very closely the pattern of the East Creek-Crawford units and Daves Hollow-East Creek on the Forest; that is the concentration of trees and the insect potential is south of East Creek, whereas north of East Creek the attacked trees are lightly dispersed throughout the stand. For this reason the area north of East Creek might be eliminated from a limited control program.

An examination of the bar graph reveals several conditions that should be discussed more completely. Why is it that the Red Canyon and Hatch Mt. units do not show a higher build up ratio? The data

indicates a high population potential as well as an upward trend of the potential index. The new attack per acre (.02) is, however, considerably lower than any other unit showing similar characteristics, and the history of this epidemic does show that the Red Canyon and Hatch Mt. units have not, up to now, produced large numbers of attacked trees nor have the trees appeared in groups. With this meager information one might surmise that the units are a few years behind most of the rest of the units in the epidemic development.

The Blue Springs Mt. unit has the requirements to fit into the zone of highest priority except for the low build up ratio and the small number of trees per acre (.04). It is difficult to draw definite conclusions, but one possible explanation is that although the potential in the Blue Springs Mt. unit is high, the total population has been materially reduced by the repeated treatment of the unit.

The primary purpose of the bar graph is to illustrate some of the data accumulated on the epidemics and to attempt to utilize it in rating the infestations by units.

Every possible effort should be made to salvage infested trees from any and all units. The cost and supervision of a salvage operation may not always be less than required for chemical control but it has the advantage of avoiding the waste of part of the local timber supply.

BLACK HILLS BEETLE

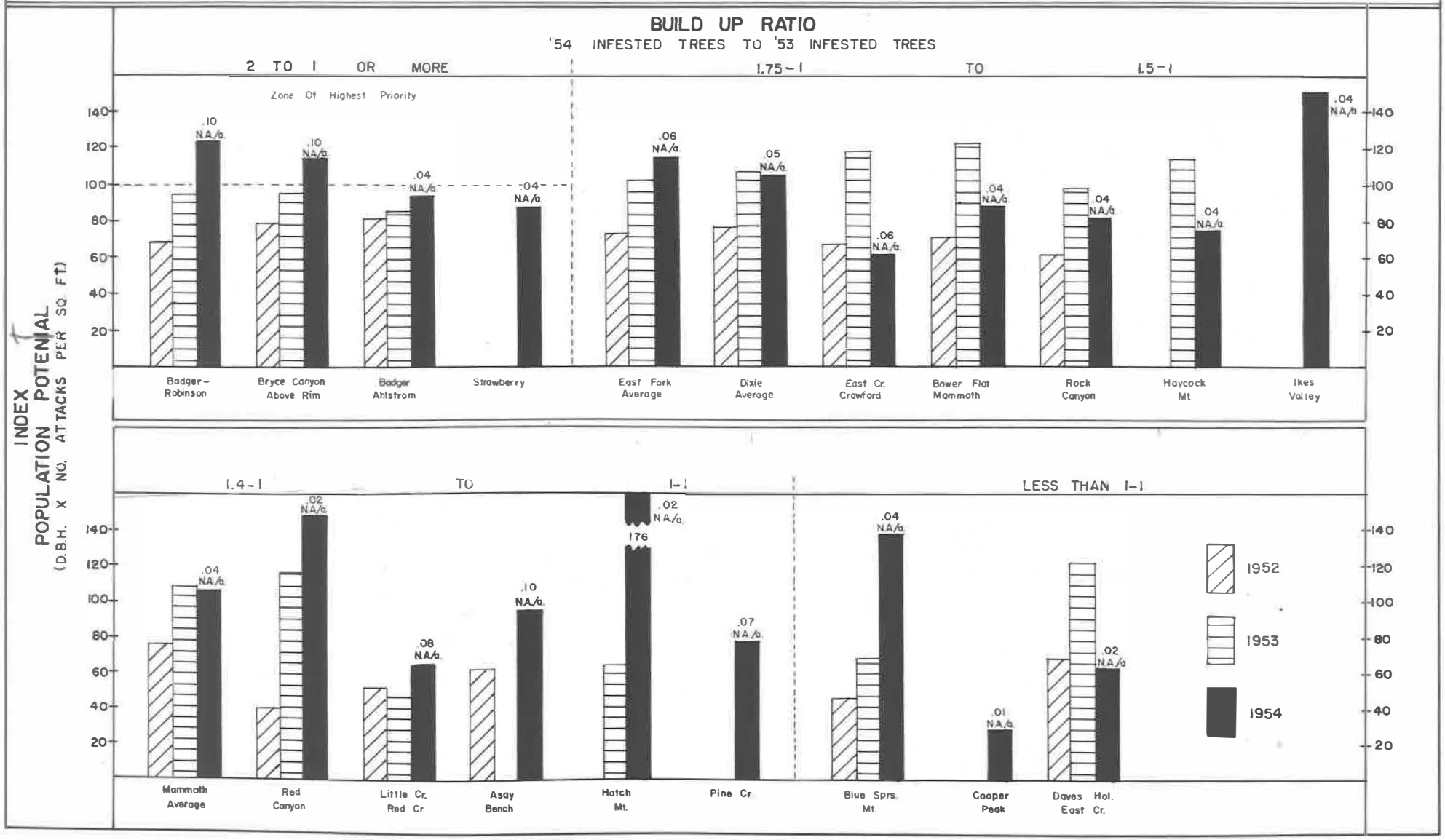
DIXIE-BRYCE PROJECT

CONTROL - SURVEY DATA

1954

UNITS	1954 CONTROL AREA: Trees Treated	Est. New Attacks	% Reduction or Increase	Area in Acres	Increase in Area	NEW AREA INFESTED: Area in Acres	Est. New Attacks	TOTALS FALL SURVEY: Area in Acres	Total Est. New Attacks	N.A./a.	S.M.E.	REMARKS :
1. Badger-Ahlstrom	1,194	580	-51 %	15,418				15,400	580±215	.038	37 %	
2. Daves Hol.-East Cr.	1/	160		7,500		952	20	8,500	180±58	.021	32 %	1/ No figures available
3. East Cr.-Crawford	1,575	615	-61 %	9,800		3,258	205	13,100	820±210	.063	26 %	
4. Badger-Robinson	774	573	-26 %	5,300		25,162	2,387	30,500	2,960±750	.097	25 %	
5. Proctor Canyon	no treatment	230		500				500	230	.460	scouted	
6. Pines-Red Canyon	42	282	+85 %	12,000		8,000	188	20,000	470	.023		
7. Ponderosa-Willis	84	15	-82 %	50		450	135	500	150	.300		
8. Barney Bluff		new	area			500	150	500	150	.300		
TOTALS EAST FORK DIVISION	3,669	2,455	-33 %	50,568	43 %	38,322	3,085	89,000	5,540±776	.060	14 %	
9. Strawberry		new	area			18,926	670	18,900	670±187	.035	28 %	
10. Bower Flat-Mammoth	1,111	710	-36 %	16,200		2,456	2/	18,700	710±160	.038	23 %	2/ Not possible to separate N.A. figures
11. Rock Canyon	723	210	-71 %	5,948				5,900	210±75	.035	38 %	
12. Haycock Mt.	489	250	-49 %	6,576				6,600	250±80	.038	32 %	
13. Blue Sprs. Mt.	203	150	-26 %	3,924				3,900	150±110	.038	73 %	
14. Cooper Peak	250	40	-84 %	3,168				3,200	40±28	.012	70 %	
15. Five Mile Bench	75	30	-60 %	1,000				1,000	30±27	.030	90 %	
16. Prince Mt.	78	10	-87 %	648				600	10±9	.017	90 %	
17. Little Cr.-Red Cr.	169	130	-23 %	1,700				1,700	130±59	.076	45 %	
18. Upper Mammoth		new	area			2,220	30	2,200	30±25	.014	83 %	
19. Lower Dry Valley	303	50	-84 %	556				600	50	.083		
20. Ikes Valley		new	area			2,572	100	2,600	100±39	.038	39 %	
21. Stout Canyon		new	area			2,630	40	2,600	40	.015		
22. Asay Bench						1,300	155	1,300	155±59	.119	38 %	
23. Hatch Mt.	10	40	+75 %	1,896				1,900	40±30	.021	75 %	
TOTALS MAMMOTH DIVISION	3,411	1,620	-53 %	42,616	42 %	30,104	995	71,700	2,615±314	.036	12 %	
24. Pine Cr.	425	320	-25 %	7,000				7,000	320±111	.046	35 %	
TOTALS DIXIE NATIONAL FOREST	7,505	4,395	-41 %	99,184	40 %	68,426	3,930	167,700	8,475±763	.050	9 %	
East Cr.-North Border		20		1,674				1,700	20±24	.069	45 %	
East Cr.-Crawford		640		8,392				8,400	640±289			
Willis Swamp		100		450				450	100			
Ponderosa						284	150	280	150			
TOTALS BRYCE CANYON NATIONAL PARK	2,200 3/	760	-65 %	10,516	3 %	284	150	10,830	910±410	.084	45 %	3/ Approximate figure

BLACK HILLS BEETLE
DIXIE - BRYCE PROJECT
SURVEY DATA



BLACK HILLS BEETLE

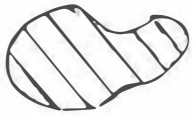
DIXIE-BRYCE PROJECT

INFESTED TREE DATA — 1954

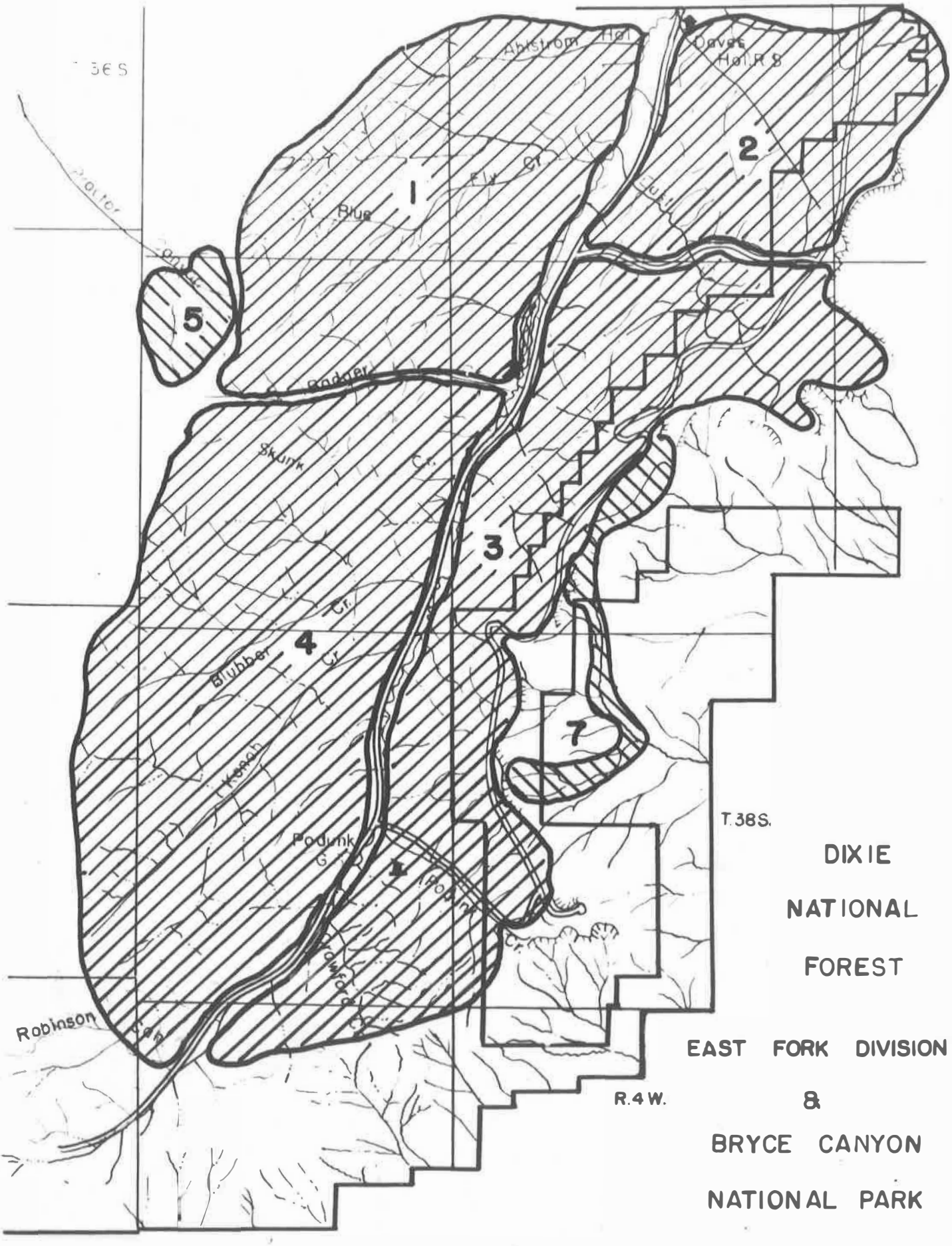
UNIT	Average D.B.H. '52	'53	'54	Ave. No. Gal. per sq. ft. '52	'53	'54	Population Potential Index '52	'53	'54	Approx. Ratio of '54 (N.A.) to '53 not treated
Badger-Ahlstrom	18.8	17.0	17.2	4.3	5.0	5.4	80.84	85.00	92.88	2.9-1
Daves Hol.-East Cr.	15.3	17.8	20.6	4.4	6.8	3.0	67.32	121.04	61.80	1-1.3
East Cr.-Crawford	15.3	19.9	14.5	4.4	6.0	4.2	67.32	119.40	60.90	1.5-1
Badger-Robinson	20.0	19.0	19.4	4.4	5.0	6.4	88.00	95.00	124.16	2-1
Pines-Red Canyon	20.0	19.3	22.5	2.0	6.0	6.6	40.00	115.80	148.50	1-1
East Fork Averages	17.0	18.5	20.0	4.3	5.6	5.7	73.10	103.6	114.0	1.75-1
Strawberry			17.6			4.4			77.44	3-1
Bower Flat-Mammoth	19.3	20.3	18.0	3.7	6.0	4.9	71.41	121.80	88.20	1.5-1
Rock Canyon	20.5	20.4	17.8	3.0	4.8	4.6	61.50	97.92	81.88	1.5-1
Haycock Mt.		25.9	16.9		4.4	4.4		113.96	74.36	1.5-1
Blue Sprs. Mt.	10.8	16.0	22.6	4.2	4.2	6.0	45.36	67.20	135.60	1-2
Cooper Peak			14.0			2.0			28.00	1-1.5
Five Mile Bench	28.5	22.0	20.0	4.0	4.0	5.0	114.00	88.00	100.00	
Prince Mt.	12.0	27.8	28.0	3.0	5.6	4.0	36.00	155.68	112.00	
Little Cr.-Red Cr.	13.0	10.9	11.4	4.0	4.4	5.6	52.00	47.96	63.84	1-1
Ikes Valley			20.4			7.4			150.96	1.5-1
Asay Bench	22.0		36.0	2.8		2.6	61.60		93.60	1-1
Hatch Mt.		14.6	22.0		4.4	8.0		64.24	176.00	1-1
Mammoth Averages	20.5	21.6	19.7	3.7	5.4	4.6	75.85	116.64	90.62	1.36-1
Pine Cr.			20.6			3.8			78.28	1-1
Dixie N. F. Averages	19.1	19.9	19.5	4.0	5.4	5.4	76.40	107.46	105.30	1.7-1
Bryce Canyon N. P.	22.0	19.9	18.3	3.5	4.8	6.2	77.00	95.52	113.46	3-1

Legend

Fall 1954 area cruised

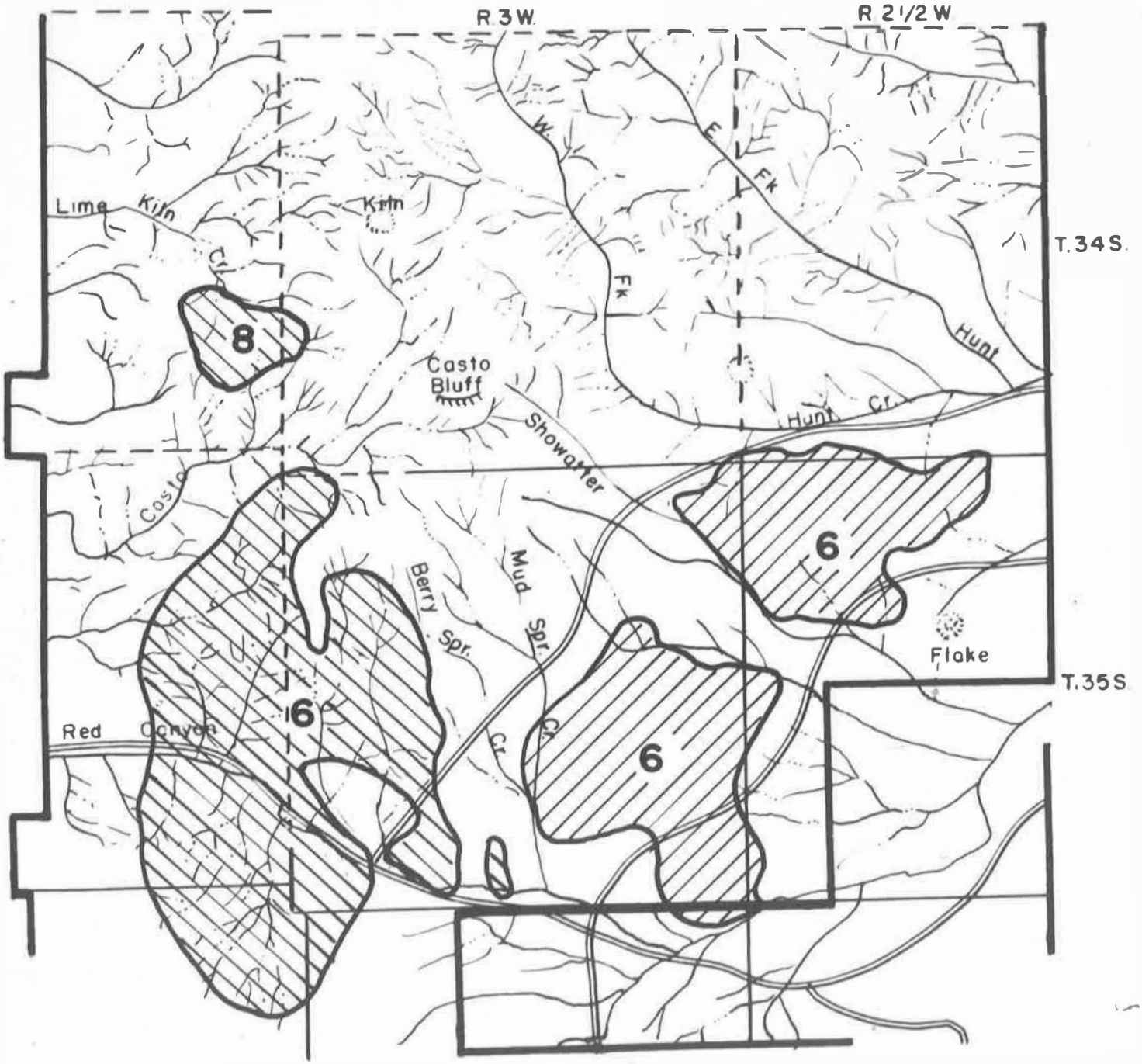


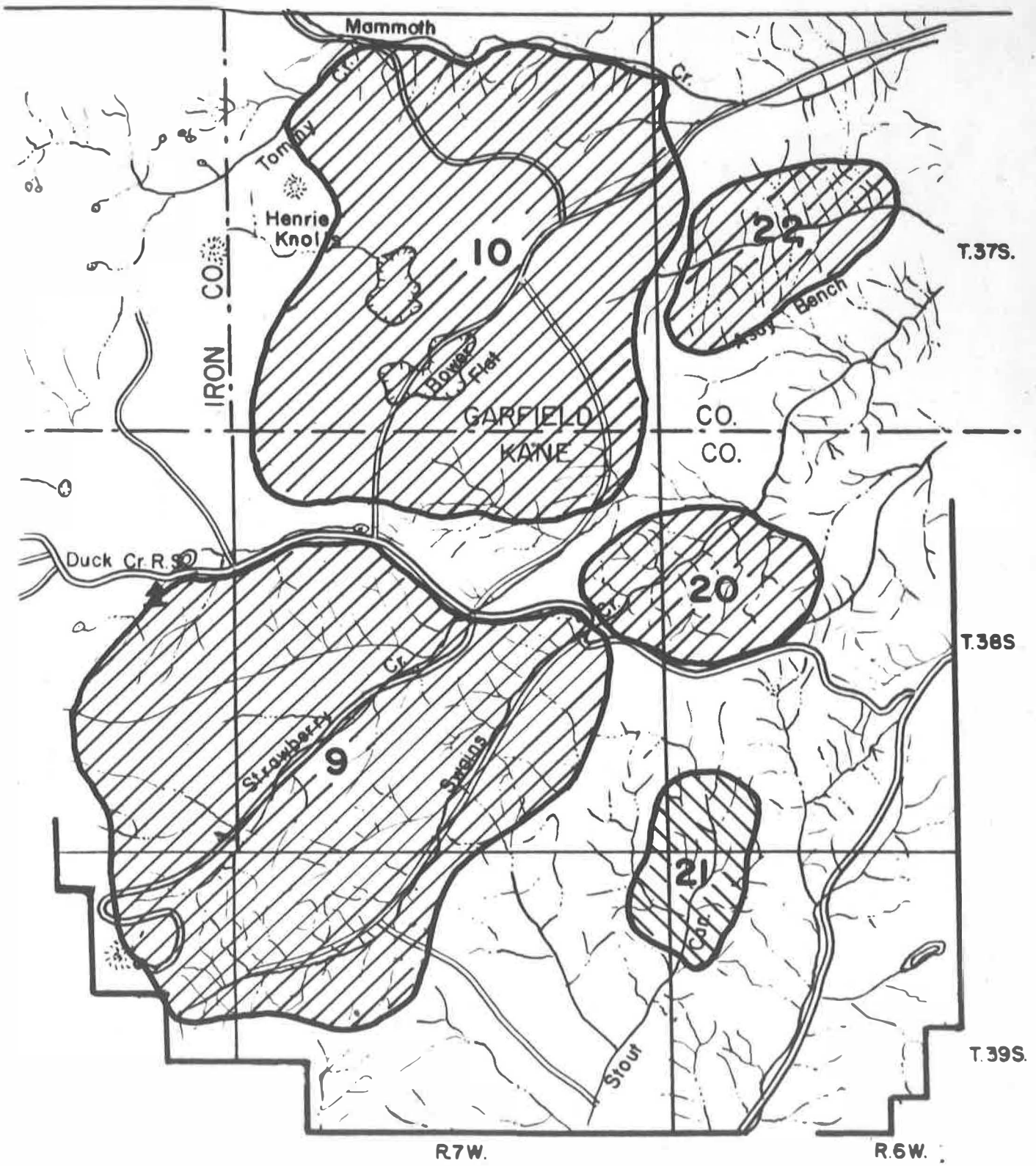
Fall 1954 area scouted


T. 36 S.
Abrstrom Hol
Dover Hol. R 8
Blue
Fly Cr.
Badger
Skunk Cr.
Blubber Cr.
Kanab
Podunk Cr.
Robinson Cr.
1
2
3
4
5
7
T. 38 S.
R. 4 W.
R. 4 1/2 W.
DIXIE
NATIONAL
FOREST
EAST FORK DIVISION
&
BRYCE CANYON
NATIONAL PARK

DIXIE NATIONAL FOREST

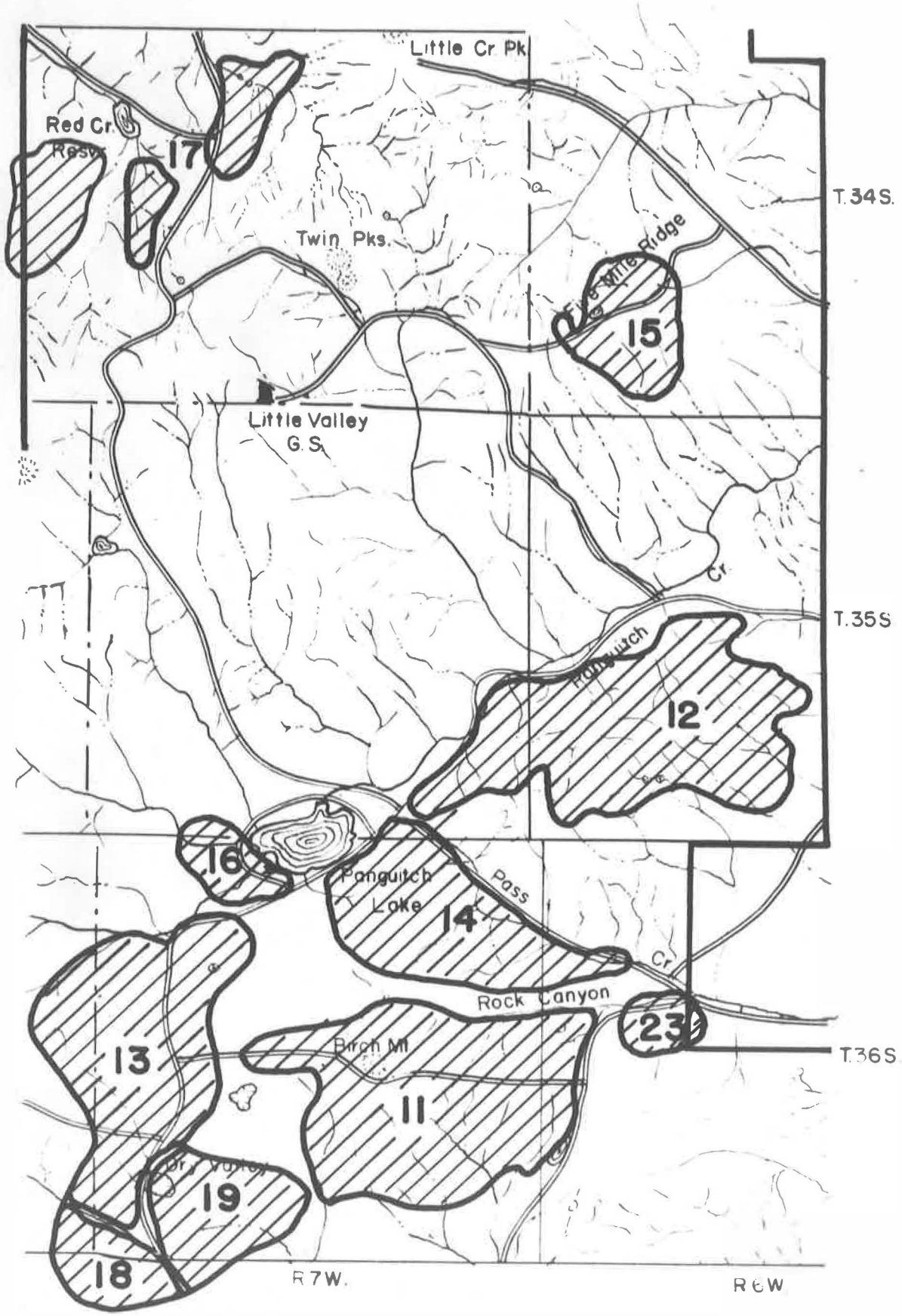
EAST FORK DIVISION





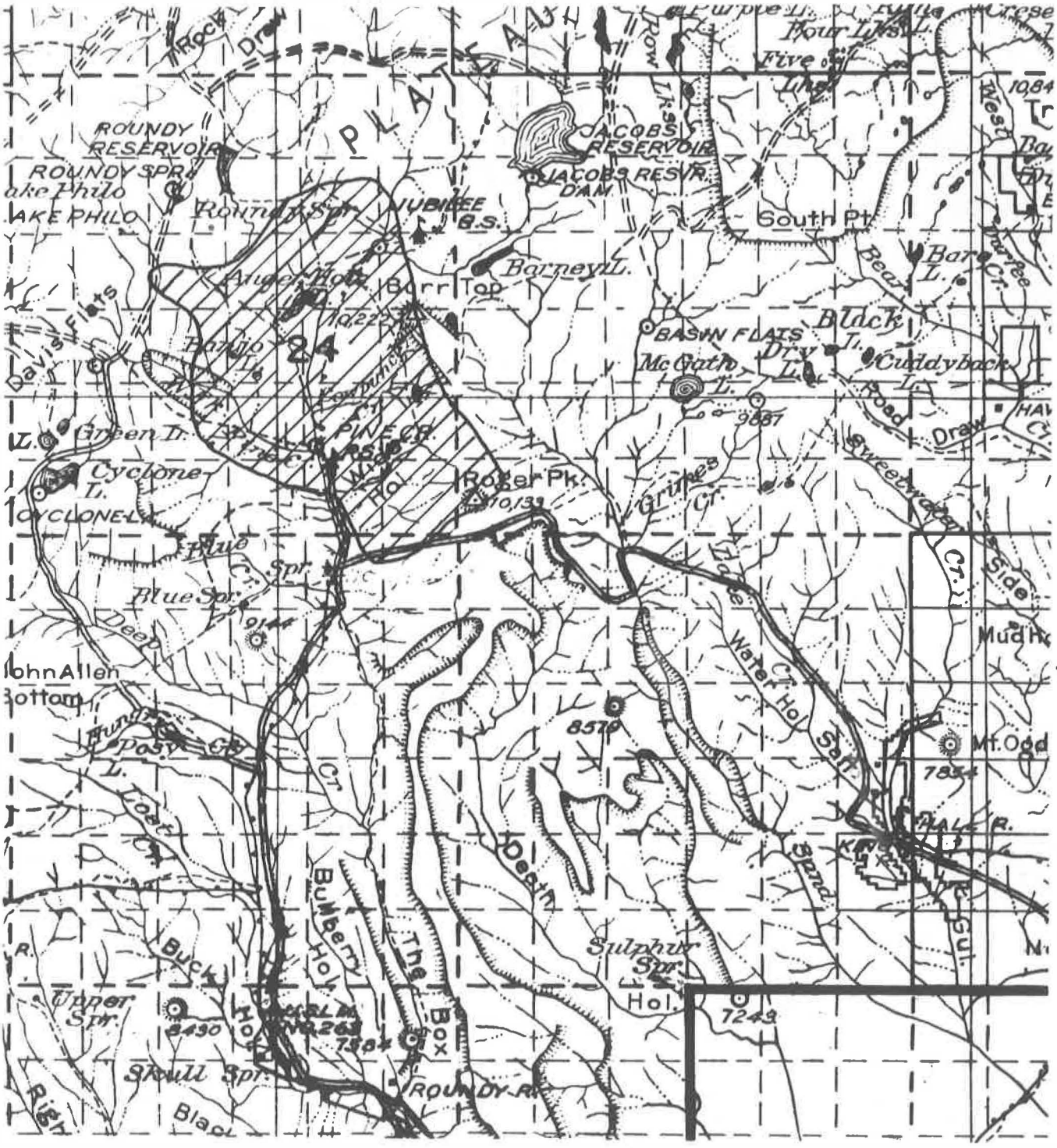
DIXIE NATIONAL FOREST

MAMMOTH DIVISION



DIXIE NATIONAL FOREST

MAMMOTH DIVISION



DIXIE NATIONAL FOREST

ESCALANTE DIVISION

1954